

Acquisition of a Thin Film Deposition System for Sample Preparation

Steven T. Herbert, Xavier University, DMR-0116113

We have purchased a **Cooke Vacuum Products Model CVE 600 EB-FR-S-DC** thin film vacuum deposition system to augment our faculty and student research programs. The fully automated pumping system consists of a student-friendly cryopump and the deposition systems include a 4-pocket e-gun, a 3" sputter gun, and a thermal evaporation source. The system will allow us to prepare metal films for fabricating superconducting devices, creating electrical contacts to samples, and studying surface physics. This instrument adds a vital piece to the department of physics infrastructure necessary to enhance our faculty and student research goals.



Above: A view of the e-gun (left side) and sputter gun (right side). The thermal source is behind the sputter gun.



Left: Undergraduate physics major Saffar Arjmandi deposits Nb metal using the e-gun, and then removes the samples.

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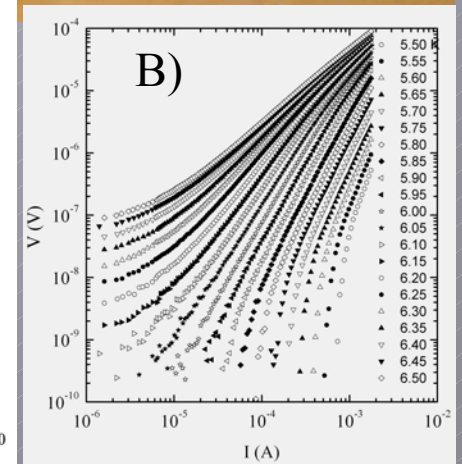
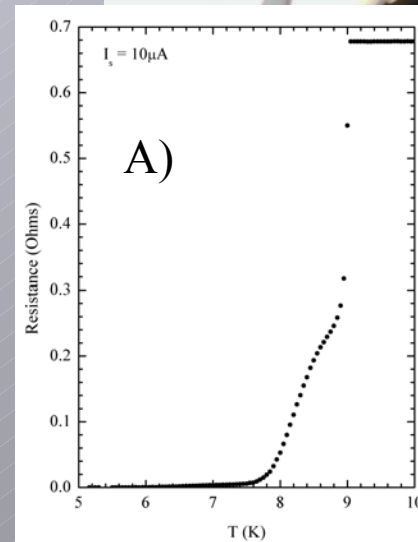
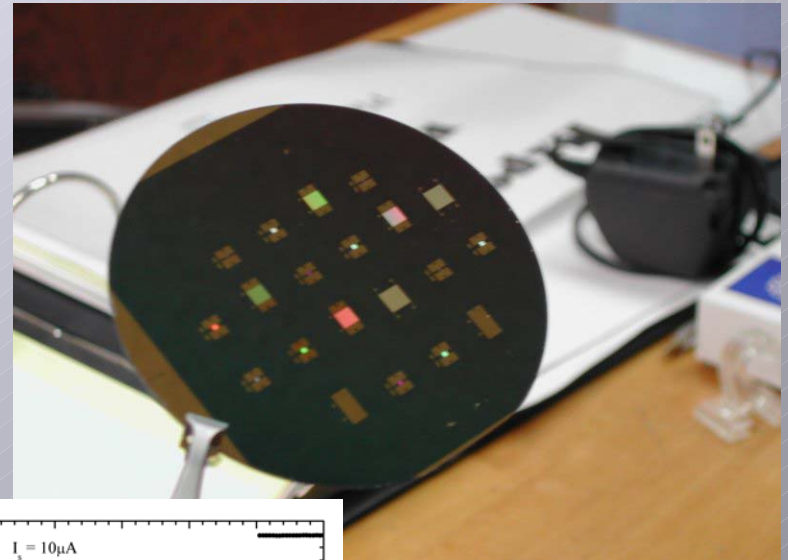
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Recent Activities

Two-dimensional (2D) Josephson junction arrays (JJA) consist of a collection of superconducting islands connected by a non-superconducting matrix. They are fabricated by patterning (via e-beam and photolithography) bilayer films of Nb and Au, deposited by e-gun and sputtering techniques. JJA's undergo a range of phase transitions and serve as model systems for many classical and quantum many-body Hamiltonians.

We are currently investigating the superconducting phase transition as the sample dimensionality goes from two to one-dimension. In addition, we are attempting to fabricate 3D JJA's by depositing multiple-layer superconductor and normal metal films, in order to extend the investigation to three-dimensions.

Above right: Si wafer containing several 2D JJA samples. Below right A) Resistance vs. temperature data for a 2D JJA sample, B) Voltage vs. Current data for a different JJA sample.



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Education and Mentoring

As an undergraduate-only program, the department of physics at Xavier University requires a senior research project in order to graduate. Students generally start research during their sophomore year and continue until their senior year, with most of the work coming during the summer months when students are supported through research grants. Research topics generally involve both theoretical and experimental work that is likely to be published in peer-reviewed journals. The work is carried out using high quality instrumentation, affording students experiences unavailable in a classroom setting.

In addition to the research requirement, much of the equipment (such as the new deposition system) is also integrated into our undergraduate curriculum in an attempt to expose student to new and exciting avenues of work as early in their career as possible.

Right: Undergraduate physics major Michael Hinton attaches contact leads to a JJA sample (above) and collects electrical transport data (below).

